

US008200956B2

(12) **United States Patent**
Arafeh

(10) **Patent No.:** **US 8,200,956 B2**
(45) **Date of Patent:** ***Jun. 12, 2012**

(54) **EFFICIENT METHOD FOR OPERATING SYSTEM DEPLOYMENT**

(75) Inventor: **Samer N. Arafeh**, Sammamish, WA (US)

(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/953,889**

(22) Filed: **Nov. 24, 2010**

(65) **Prior Publication Data**

US 2011/0072256 A1 Mar. 24, 2011

Related U.S. Application Data

(63) Continuation of application No. 11/949,495, filed on Dec. 3, 2007, now Pat. No. 7,865,711.

(51) **Int. Cl.**
G06F 15/177 (2006.01)

(52) **U.S. Cl.** **713/2; 713/1**

(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,874,060	B2	3/2005	Blood
6,961,941	B1	11/2005	Nelson et al.
7,243,224	B2	7/2007	Nair
7,356,679	B1	4/2008	Le et al.
7,865,711	B2	1/2011	Arafeh
2003/0110351	A1	6/2003	Blood et al.
2005/0160150	A1	7/2005	Kao
2005/0160256	A1	7/2005	Huang et al.

2006/0010316	A1	1/2006	Burokas
2006/0020779	A1	1/2006	Makiyama
2006/0036832	A1	2/2006	Makiyama
2006/0064688	A1	3/2006	Tseng
2006/0143433	A1	6/2006	Stutton
2007/0005919	A1	1/2007	van Riel
2007/0162901	A1	7/2007	Oh
2007/0260831	A1	11/2007	Michae et al.
2008/0120403	A1	5/2008	Lowery et al.

OTHER PUBLICATIONS

Notice of Allowance mailed Aug. 19, 2010 in U.S. Appl. 11/949,495. "Ways to Deploy an Operating System to a Virtual Machine," 2 pages, 2007, Microsoft Corporation, <http://technet2.microsoft.com/windowsserver/en/library/37e6a477-b308-457c9653-31ec3c43a9671033.aspx?mfr=true>.

Vmware Workstation 4.5, http://www.vmware.com/support/ws45/doc/disks_config_ws.html.

"Installing an Operating System onto a Raw Partition from a Virtual Machine Using Vmware Workstation for Linux," 4 pages, accessed Aug. 10, 2007, http://www.vmware.com/support/refefence/linux/ostonpartition_linux.html.

International Search Report and Written Opinion, International Application PCT/US2008/084412, mailed Oct. 1, 2009, 10 pages.

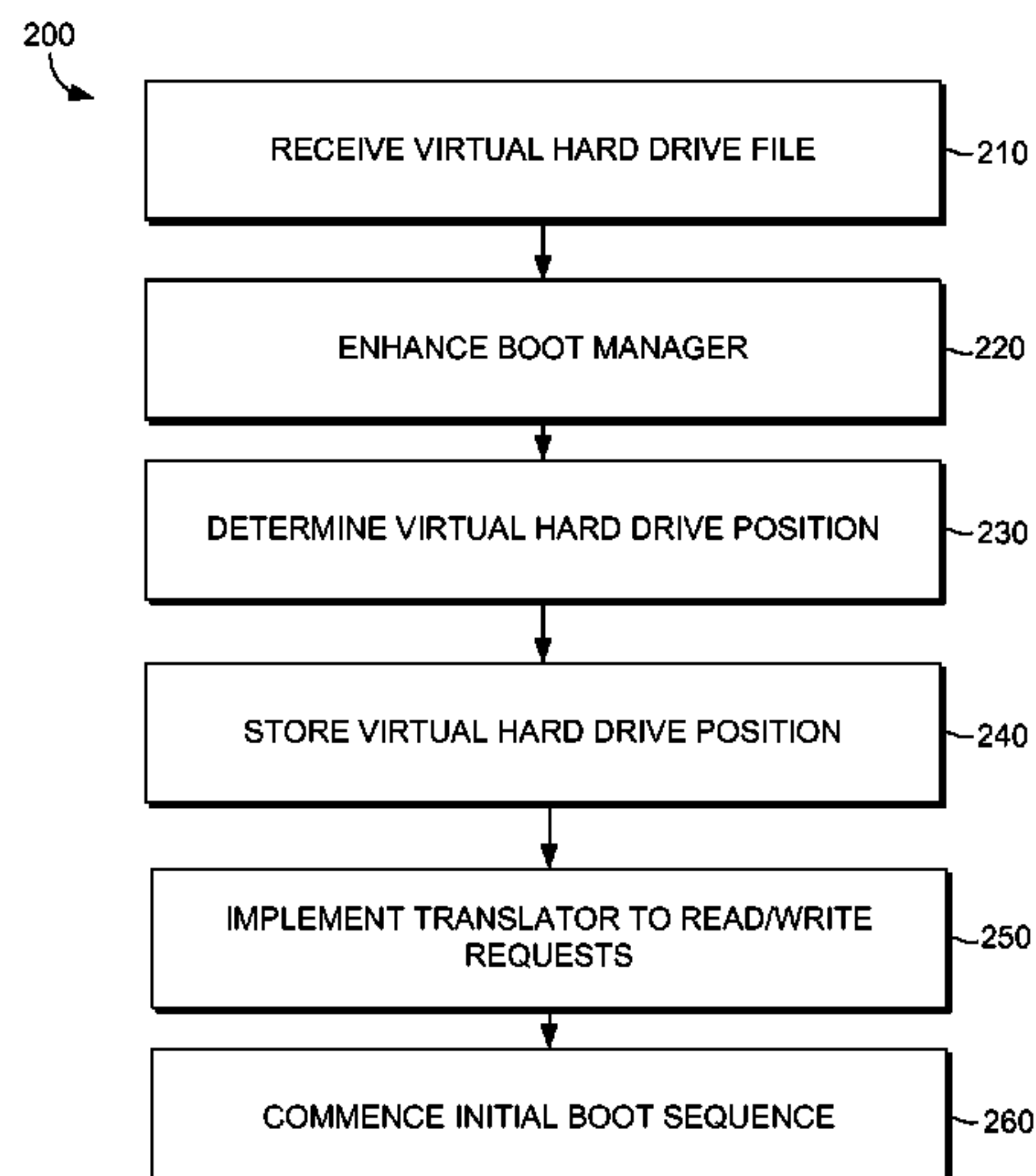
Primary Examiner — Dennis M Butler

(74) *Attorney, Agent, or Firm* — Shook Hardy & Bacon LLP

(57) **ABSTRACT**

Method and computer storage media for efficiently deploying an operating system are provided. A virtual hard drive file is communicated by a computing device, such as a server. The virtual hard drive file may be compounded with a boot manager enhancer and/or a translator. Upon receipt of the virtual hard drive file, a computing device is enhanced to expose and mount the virtual hard drive as a drive and boot option for the computing device. Thereafter, an initial boot sequence may be commenced utilizing the virtual hard drive file as the boot source. In some embodiments, a boot manager enhancer and a translator are utilized to do one or more of expose, mount, and translate the virtual hard drive file. In some embodiments, a virtual SCSI miniport driver is utilized to do one or more of expose, mount, and translate the virtual hard drive file.

20 Claims, 5 Drawing Sheets



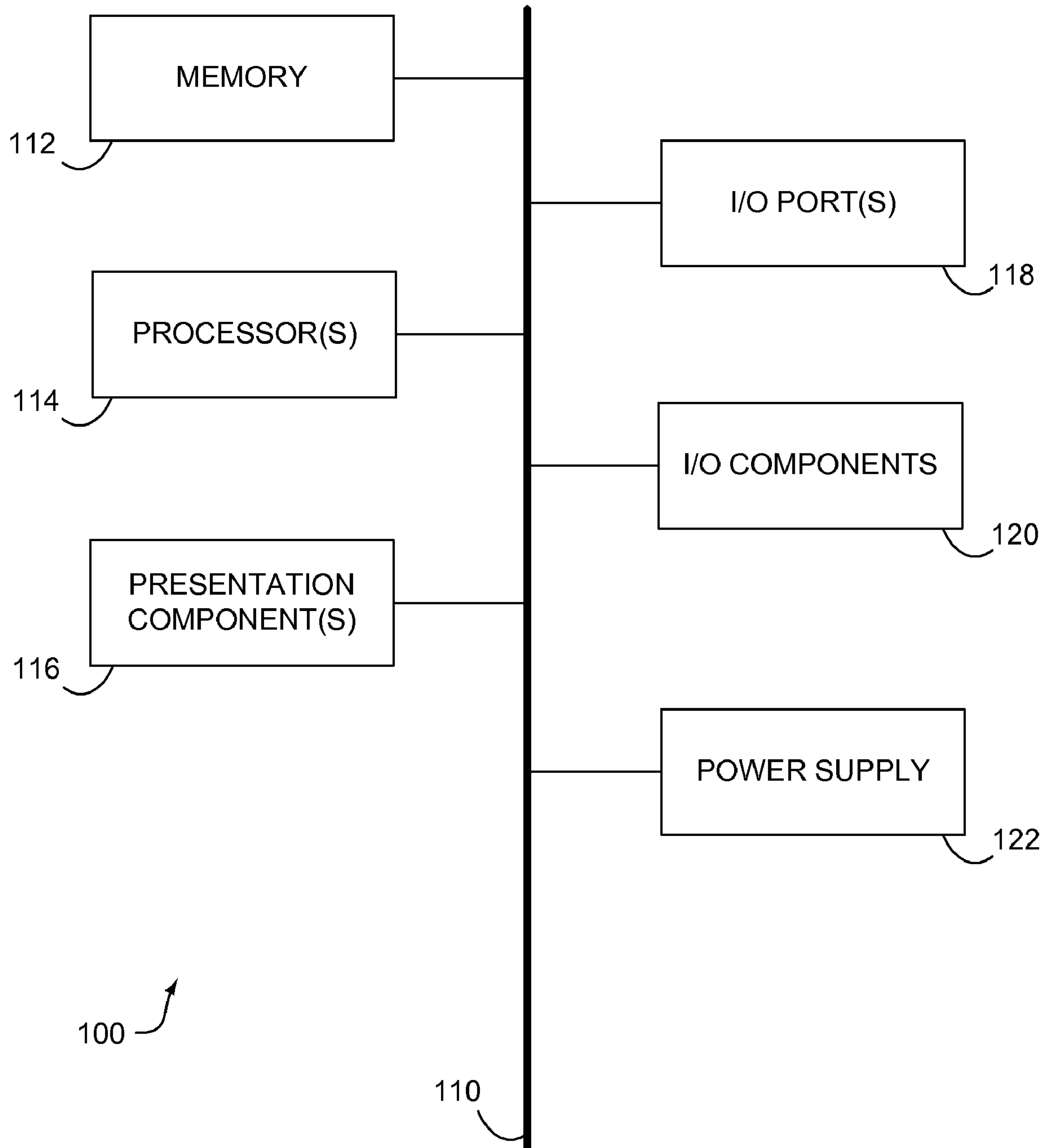
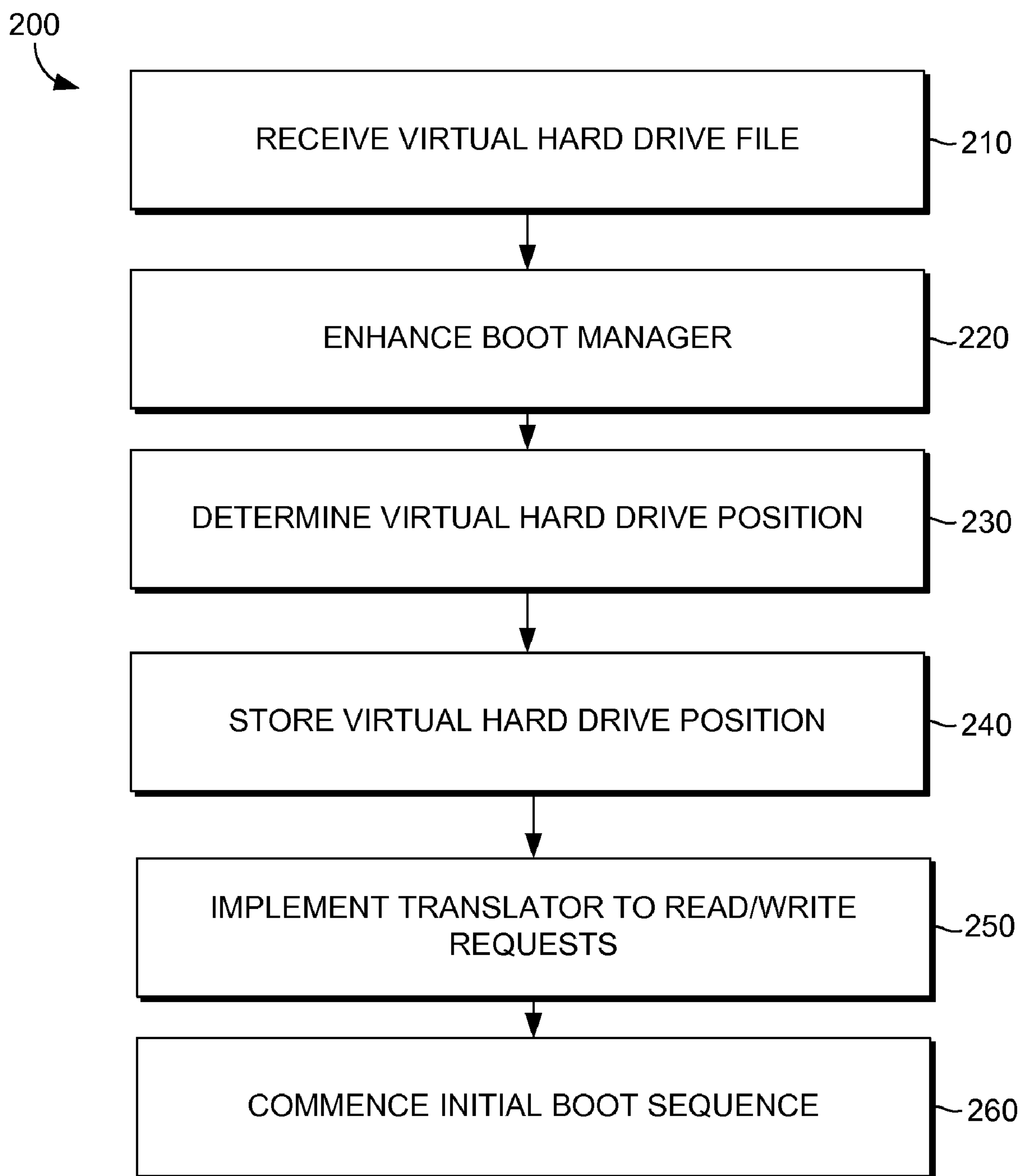


FIG. 1.

*FIG. 2.*

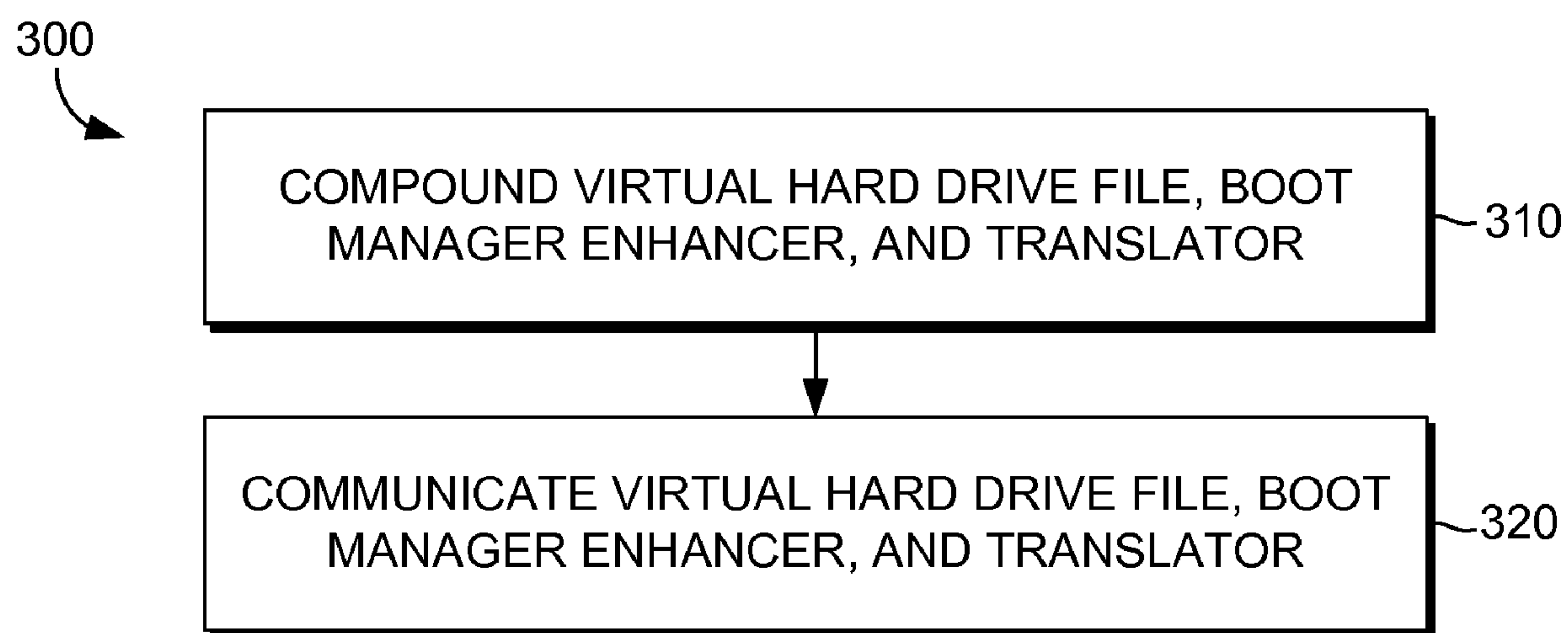
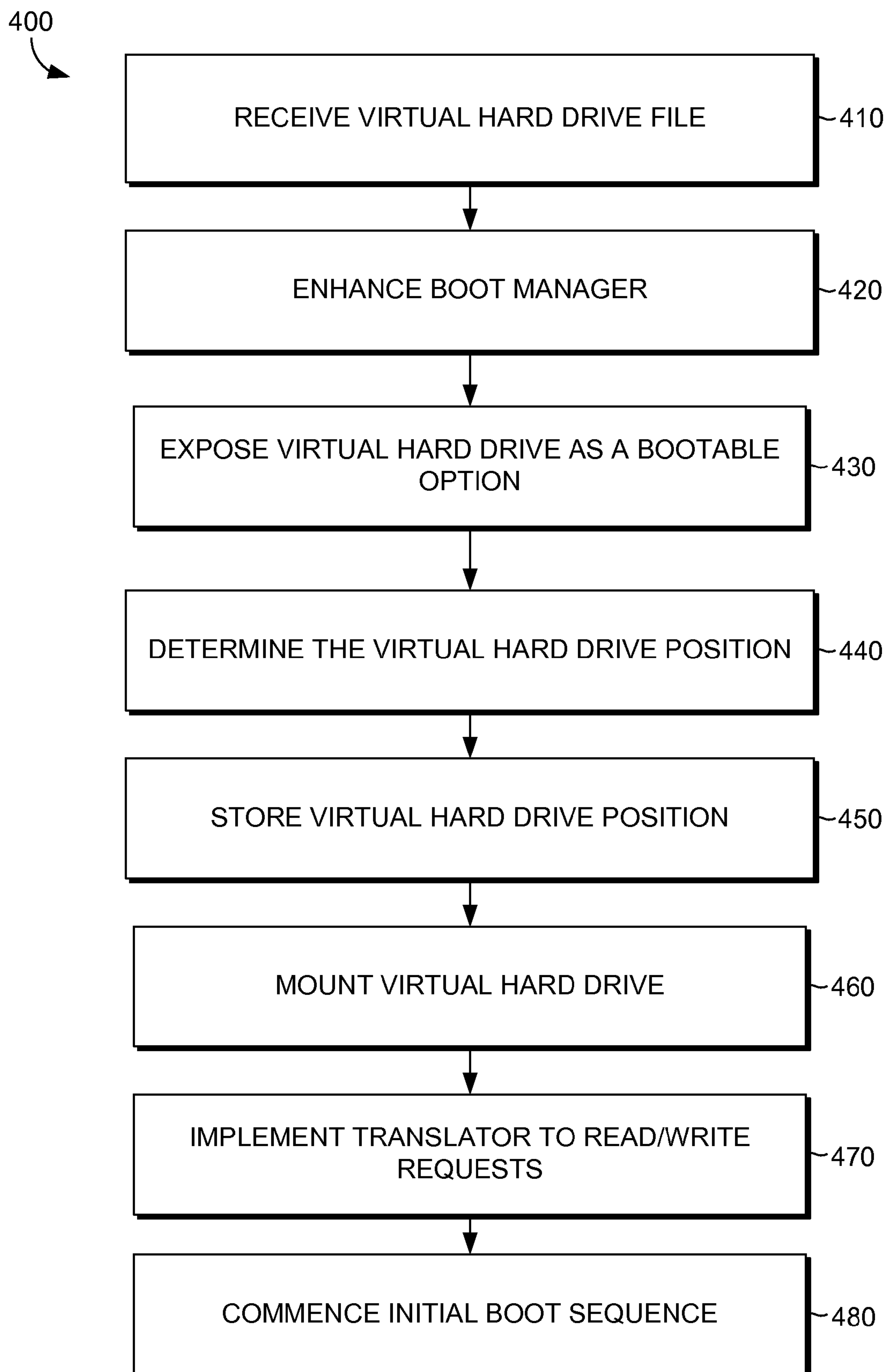


FIG. 3.

*FIG. 4.*

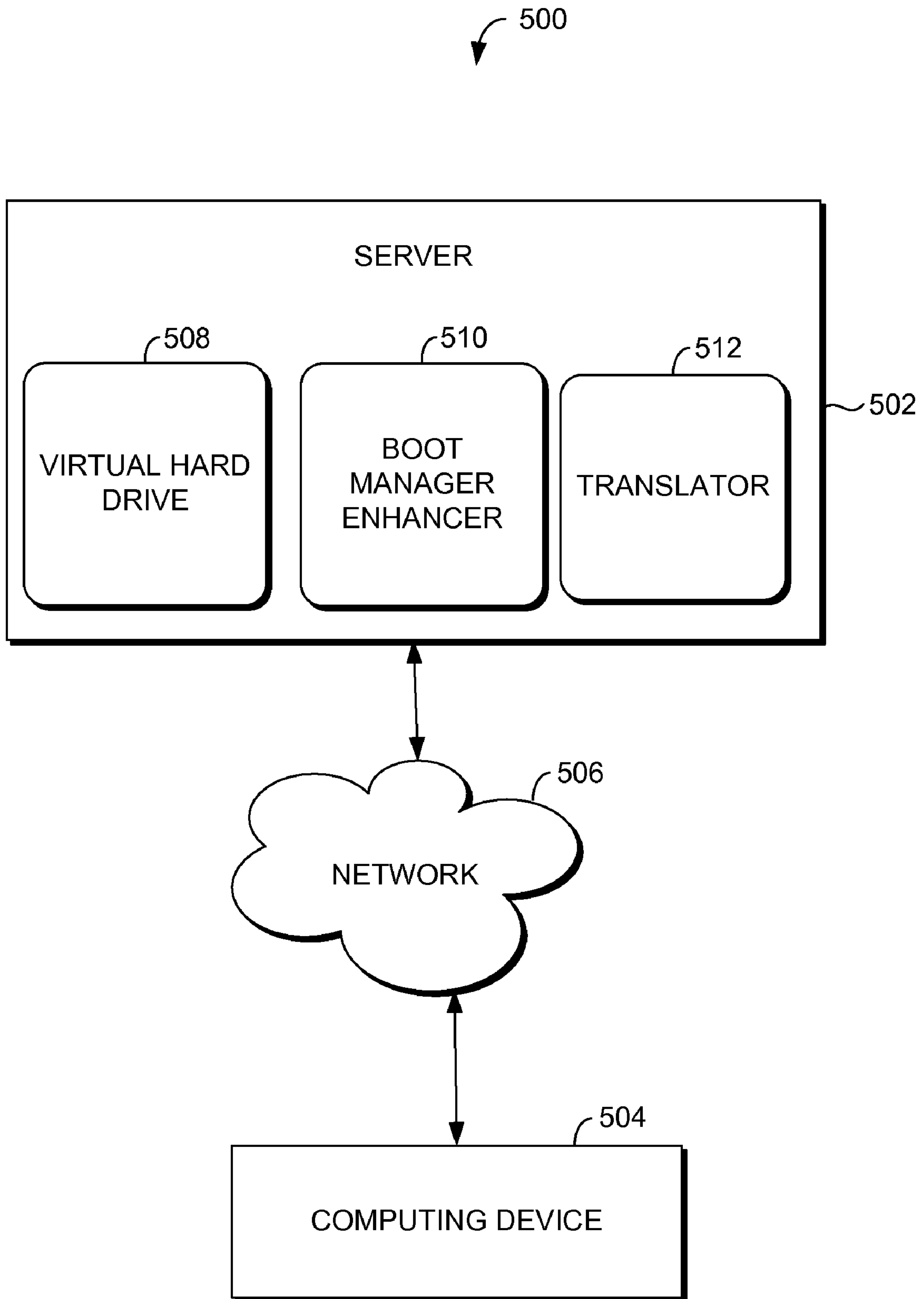


FIG. 5.

1

EFFICIENT METHOD FOR OPERATING SYSTEM DEPLOYMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a Continuation Application that claims the benefit of U.S. patent application Ser. No. 11/949,495, filed Dec. 3, 2007, entitled "EFFICIENT METHOD FOR OPERATING SYSTEM DEPLOYMENT," the entirety of which is incorporated by reference herein.

BACKGROUND

Generally, an operating system is a large collection of individual files that all work in combination to provide an operating environment for a computing device. The individual files that comprise an operating system are typically maintained within the computing device in a complex arrangement of directories and folders. Additionally, the deployment and distribution of an operating system or a portion of an operating system to remote nodes or computing devices may be a difficult task because of the size and complexity of the operating system at each of the remote computing devices.

SUMMARY

Embodiments of the present invention relate to methods and computer storage media for efficiently deploying an operating system. A compounded virtual hard drive file, that at least contains operating system instructions, is distributed to a computing device. Upon receiving the virtual hard drive file, the computing device is enhanced to allow the virtual hard drive file to be a boot option and a mountable drive. The computing device may then utilize the virtual hard drive file as a drive beginning with the initial boot sequence.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments are described in detail below with reference to the attached drawing figures, wherein:

FIG. 1 is a block diagram of an exemplary computing environment suitable for use in implementing embodiments of the present invention;

FIG. 2 is a flow diagram of an exemplary method for deploying an operating system on a computing device, in accordance with an embodiment of the present invention;

FIG. 3 is a flow diagram of an embodiment of the method for the efficient deployment of an operating system, in accordance with an embodiment of the present invention;

FIG. 4 is a flow diagram of another exemplary method for the efficient deployment of an operating system, in accordance with an embodiment of the present invention; and

FIG. 5 is a block diagram illustrating an exemplary computing system architecture configured for use in implementing embodiments of the present invention.

DETAILED DESCRIPTION

The subject matter of embodiments of the present invention is described with specificity herein to meet statutory

2

requirements. However, the description itself is not intended to limit the scope of this patent. Rather, the inventors have contemplated that the claimed subject matter might also be embodied in other ways, to include different steps or combinations of steps similar to the ones described in this document, in conjunction with other present or future technologies. Moreover, although the terms "step" and/or "block" may be used herein to connote different elements of methods employed, the terms should not be interpreted as implying any particular order among or between various steps herein disclosed unless and except when the order of individual steps is explicitly described.

Embodiments of the present invention relate to methods and computer storage media for efficiently deploying an operating system. A compounded virtual hard drive file, that contains operating system instructions, is distributed to a computing device. Upon receiving the virtual hard drive file, the computing device is enhanced to allow the virtual hard drive file to be a boot option and a mountable drive. The compounded virtual hard drive file may contain additional data and information that will allow the virtual hard drive file to be exposed as a boot option and to be mounted as a drive in the computing device. The computing device may then utilize the virtual hard drive file as a physical drive beginning with the initial boot sequence.

Accordingly, in one aspect, the present invention provides a method for deploying an operating system to a computing device. The method includes communicating, from a server to the computing device, a virtual hard drive (VHD) file having one or more operating system instructions. The method also includes communicating a boot manager enhancer able to enhance a boot manager of the computing device. Additionally, the method includes communicating a translator able to apply a VHD file position at the computing device to read/write requests. The VHD and at least one of the boot manager enhancer or the translator are compounded as a compounded drive prior to communicating from the server to the computing device, wherein the compounded drive is useable by the computing device for commencing an initial boot sequence.

In another aspect, the present invention provides non-transitory computer storage media having computer-executable instructions embodied thereon that, when executed by a processor, performs a method for deploying a computing device operating system. The method includes, at a server, compounding a virtual hard drive (VHD) file and at least a boot manager enhancer or a translator as a compounded drive. The method also includes communicating the compounded drive to the computing device. The compounded drive is capable of performing an initial boot sequence on the computing device.

A third aspect of the present invention provides non-transitory computer storage media having computer-executable instructions embodied thereon that, when executed by a processor, performs a method for deploying an operating system to a computing device. The method includes compounding a virtual hard drive (VHD) that can be exposed and mounted as a SCSI disk at the computing device and at least one of: (1) a boot manager enhancer able to provide a boot entry that exposes the VHD as a boot option to the computing device, or (2) a translator able to translate read/write requests between a logical offset and a physical offset based on a VHD file position at the computing device. The method also includes communicating from a server to the computing device the compounded VHD, wherein the compounded VHD is able to be utilized in an initial boot sequence of the computing device.

Having briefly described an overview of embodiments of the present invention, an exemplary operating environment suitable for implementing embodiments hereof is described below.

Referring to the drawings in general, and initially to FIG. 1 in particular, an exemplary operating environment suitable for implementing embodiments of the present invention is shown and designated generally as computing device 100. Computing device 100 is but one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the invention. Neither should the computing environment 100 be interpreted as having any dependency or requirement relating to any one or combination of modules/components illustrated.

Embodiments may be described in the general context of computer code or machine-useable instructions, including computer-executable instructions such as program modules, being executed by a computer or other machine, such as a personal data assistant or other handheld device. Generally, program modules including routines, programs, objects, modules, data structures, and the like, refer to code that performs particular tasks or implements particular abstract data types. Embodiments may be practiced in a variety of system configurations, including hand-held devices, consumer electronics, general-purpose computers, specialty computing devices, etc. Embodiments may also be practiced in distributed computing environments where tasks are performed by remote-processing devices that are linked through a communications network.

With continued reference to FIG. 1, computing device 100 includes a bus 110 that directly or indirectly couples the following devices: memory 112, one or more processors 114, one or more presentation modules 116, input/output (I/O) ports 118, I/O modules 120, and an illustrative power supply 122. Bus 110 represents what may be one or more busses (such as an address bus, data bus, or combination thereof). Although the various blocks of FIG. 1 are shown with lines for the sake of clarity, in reality, delineating various modules is not so clear, and metaphorically, the lines would more accurately be grey and fuzzy. For example, one may consider a presentation module such as a display device to be an I/O module. Also, processors have memory. The inventors hereof recognize that such is the nature of the art, and reiterate that the diagram of FIG. 1 is merely illustrative of an exemplary computing device that can be used in connection with one or more embodiments. Distinction is not made between such categories as "workstation," "server," "laptop," "hand-held device," etc., as all are contemplated within the scope of FIG. 1 and reference to "computer" or "computing device."

Computing device 100 typically includes a variety of computer-readable media. By way of example, and not limitation, computer-readable media may comprise Random Access Memory (RAM); Read Only Memory (ROM); Electronically Erasable Programmable Read Only Memory (EEPROM); flash memory or other memory technologies; CDROM, digital versatile disks (DVD) or other optical or holographic media; magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to encode desired information and be accessed by computing device 100.

Memory 112 includes computer-storage media in the form of volatile and/or nonvolatile memory. The memory may be removable, non-removable, or a combination thereof. Exemplary hardware devices include solid-state memory, hard drives, optical-disc drives, etc. Computing device 100 includes one or more processors that read data from various entities such as memory 112 or I/O modules 120. Presentation

module(s) 116 present data indications to a user or other device. Exemplary presentation modules include a display device, speaker, printing module, vibrating module, and the like. I/O ports 118 allow computing device 100 to be logically coupled to other devices including I/O modules 120, some of which may be built in. Illustrative modules include a microphone, joystick, game pad, satellite dish, scanner, printer, wireless device, and the like.

With reference to FIG. 2, a flow diagram is shown that illustrates an exemplary method 200 for deploying an operating system on a computing device, in accordance with an embodiment of the present invention. Initially, as indicated at block 210, a virtual hard drive file is received. In addition to receiving the virtual hard drive file, at least a boot manager enhancer and a translator are received. The virtual hard drive file, the boot manager enhancer, and the translator may be received as a single file or they may be received as two or more files. In embodiments, the virtual hard drive file, the boot manager enhancer, and the translator are received in connection with one or more computer readable media.

The virtual hard drive file received at block 210 generally includes operating system instructions for a computing device, such as the computing device 100 of FIG. 1. An operating system or operating system instructions that may be included with, or in a virtual hard drive file, include software that manages the sharing of resources of a computer system and provides an interface to access those resources. The virtual hard drive file may additionally include one or more of a driver, an operating system loader, a boot loader, an additional stage boot loader, program modules, and other components known to those skilled in the art to facilitate the initial boot sequence of a computing device. The virtual hard drive file is a dynamic file that allows the manipulation of the data and information contained within. This dynamic characteristic of a virtual hard drive file allows persistent data to be maintained in association with and/or on the virtual hard drive file. This is advantageous because a static format does not allow for a traditional operating system experience if data and information is not capable of being persistent.

Subsequently, as indicated at block 220, the boot manager is enhanced. The boot manager may be enhanced by the boot manager enhancer, where the enhancement may include the addition of a boot entry within the boot manager that exposes the virtual hard drive file as a boot option for the computing device. A boot manager typically includes boot entries for available sources of bootable instructions. The enhancement of the boot manager to include a boot entry for the virtual hard drive allows the virtual hard drive to be included as a bootable option for the computing device. In order for a virtual hard drive file to be exposed as a boot option to a computing device, the boot manager enhancer may provide information to the computing device that is typically supplied by a physical drive. A physical drive traditionally includes a hard disk drive, floppy drive, tape drive, CDROM, DVD, or similar media drive. The information that is typically supplied by a physical disk, and therefore may be supplied by the boot manager enhancer, includes header and footer information detailing the specifications of an associated drive. The boot-manager-enhancer-supplied header and footer information supplements the virtual hard drive file so that it becomes a drive that may be exposed and mounted.

The enhancement of the boot manager by the boot manager enhancer may require additional intervention by a computing device or a user of the computing device. This additional intervention may include the manipulation of computing instructions contained with the operating system or an alteration of components of the operating system. Additionally,

5

the boot manager enhancer may also enhance an operating system loader and a kernel of the computing device to allow the virtual hard drive file to be exposed and mounted as a drive in the computing device.

With reference to block **230**, the position of the virtual hard drive file is then determined. The virtual hard drive can be stored in association with the computing device once it has been received. In an exemplary embodiment, the virtual hard drive file is stored on a hard disk associated with the computing device once it has been received by the computing device. It will be understood and appreciated by those skilled in the art that the virtual hard drive file may be stored, held, or located on any of the computer readable media, devices, or components previously discussed in association with computing device **100**.

A position of the virtual hard drive file may be indicated in various ways. For example, the position of the virtual hard drive file may be indicated by one or more of the drive identifier, directory, track, sector, range, or partition location of the hard disk where the virtual hard drive file is stored. As an exemplary determination of the position of the virtual hard drive, the position may be identified by partition locations where the virtual hard drive file resides on a physical hard drive of the computing device.

As seen at block **240**, the virtual hard drive position is stored. The position of the virtual hard drive may be stored within the computing device, for instance in the memory **112** previously discussed in relation to computing device **100** of FIG. **1**. In addition to the virtual hard drive position being stored locally, the virtual hard drive position, as determined in block at **230** may also be stored over a network or other remote location.

At block **250**, the translator is implemented to read/write requests. The translation at block **250** may translate one or more read and write (read/write) requests that are communicated by the computing device to the memory, the driver, the volume driver, and/or the disk driver being utilized in association with the requests. The read/write requests may be generated by a processor, for instance, processor **114** of FIG. **1**, and directed to a memory, e.g., memory **112** of FIG. **1**. An example of translating read/write requests includes translating a read/write request from a processor of the computing device that received the virtual hard drive file at block **210** to the virtual hard drive utilizing the position that is stored, as indicated at block **240**. In this example the processor generates a read/write request that is directed to a physical hard disk associated with the computing device where the virtual hard drive has been stored. The translator applies the position of the virtual hard drive file to create a translation between the requested physical offset and the virtual hard drive file's logical offset. The logical offset is known as a result of the determined and stored position of the virtual hard drive file, as illustrated at blocks **230** and **240**, respectively. In this example the processor generates a read/write request directed to a physical offset of a physical disk that contains a virtual hard drive file. The read/write request is then translated based on the physical offset of the drive and the logical offset of the virtual hard drive file. It will be understood and appreciated by those skilled in the art that the translation between a physical offset and a logical offset is not limited to one direction of translation. The translation may also occur between a logical offset and a physical offset. Additionally, the translation may occur between other commands and requests issued by the computing device and its associated processor. The translator is not limited to read/write requests nor is it limited to translation based on the offset locations of the virtual hard drive file, the physical drive, or the request. Any and all such

6

embodiments, and any combination thereof, are contemplated to be within the scope of embodiments of the present invention.

The translation represented at block **250** allows the read/write requests generated by the computing device to be translated not only based on the physical drive in association with which the virtual hard drive file resides, but the translator may also translate to and from other identifying positions associated with the virtual hard drive. For example, the logical offset previously mentioned may include blocks within the virtual hard drive file. Because the virtual hard drive file may not be a physical disk, the virtual hard drive may not utilize all of the previously mentioned position identifiers, but instead, the translator may translate to a block position within the virtual hard drive file. This translation allows a read/write request that was generated as a physical offset to be translated to a logical offset that may include block position references within the virtual hard drive file.

As indicated at block **260**, the initial boot sequence is subsequently commenced. A computing device may perform an initial boot sequence anytime that the processor is booted and the processor has to search for a BIOS ROM to start a BIOS boot program. This occurs when the processor does not have instructions stored in its associated volatile memory. Typically, an initial boot sequence will occur when a computing device has been without power or turned off. These initial boot sequences may sometimes be referred to as a cold boot. An initial boot can be contrasted to a "warm" boot. A warm boot is a boot sequence where the computing device begins to boot from a condition where data is stored in the processor's associated memory. An example of a warm boot is when a computing device user provides an input of ALT+CTRL+DELETE in a WINDOWS XP based operating system, available from Microsoft Corporation of Redmond Wash. In this situation the computing device has been functioning and data is stored in the processor's memory. An example of an initial boot or cold boot in a WINDOWS XP operating system environment is if the computing device has been powered completely down, commonly referred to as shut down, prior to commencing a boot sequence.

When a computing device that is currently utilizing a first operating system begins to emulate a second operating system, that boot of the emulated operating system is not an initial boot. In this situation, the computing device is functioning with the first operating system prior to booting the additional operating system. Because the first operating system is functioning on the computing device, the processor has data stored in its associated memory at the commencement of the boot and therefore the booting of the emulated operating system is not an initial boot.

One or more of the virtual hard drive, the boot manager enhancer, and/or the translator may contain a disk driver that allows the virtual hard drive file to be mounted as a disk in the computing device. Mounting of a disk in the computing device allows the computing device to access the data contained on the disk. In order for a disk to be mounted, there generally is a disk driver that facilitates the mounting and the resulting access to the data contained therein. The driver may allow access under any commonly known format such as, but not limited to, parallel ATA, integrated drive electronics, EIDE, serial ATA, SATA, SCSI, serial attached SCSI, SAS, enhanced small disk interface, fibre channel, fibre channel arbitrated loop, and FireWire interfaces. It will be recognized by one skilled in the art that various interfaces are available to mount a disk within the computing device. In embodiments of the present invention, the interface includes a SCSI driver that allows the virtual hard drive file to be exposed and mounted as

a drive in a computing device. Additionally, in embodiments, the interface contains a SCSI miniport driver to facilitate exposing and mounting of the virtual hard drive file. A SCSI miniport driver utilizes a supplied port driver that acts as an interface between a SCSI miniport driver and the operating system. The SCSI miniport driver may therefore be a smaller driver because of an associated port driver. A SCSI driver or SCSI miniport driver may be used to expose and mount a virtual hard drive file and the resulting mounted virtual hard drive file may be recognized and utilized as a SCSI drive by a computing device.

Turning now to FIG. 3, a flow diagram is illustrated that shows an exemplary embodiment of a method **300** for the efficient deployment of an operating system, in accordance with an embodiment of the present invention. Initially, as indicated at block **310**, one or more of a virtual hard drive file, a boot manager enhancer, and/or a translator are compounded. Compounding, as used herein, can include the packaging or combining of the one or more files, instructions, or coding such that each individual element compounded may be individually identified, extracted, or manipulated from the whole of the resultant compound. Compounding allows for the plurality of elements to be grouped such that the resulting compound is an aggregate of the original elements. A resulting compound may be referred to as a compound drive or a compound file in some examples. In an embodiment of the invention, the resulting compound consists of two or more files where one of the elements that comprise the compound remains as an individual element that is separate from the remaining compound. It will be understood and appreciated by those skilled in the art that the virtual hard drive file, the boot manager enhancer, and the translator may be one file or several files prior to the compounding of block **310**. In an additional embodiment the boot manager enhancer and the translator are incorporated into other program modules, code, or instructions contained within the virtual hard drive file. The boot manager enhancer that is compounded at block **310** enhances a boot manager of a computing device with a boot entry that exposes the virtual hard drive file as a bootable drive option to the computing device. Additionally, the translator compounded at block **310** performs a translation between a physical offset and a logical offset for read/write requests. The resulting one or more compounds are also stored at block **310** for later communication.

Referring now to block **320**, the virtual hard drive file, boot manager enhancer, and/or translator are subsequently communicated. Once one or more of these elements have been compounded, the resulting compound is communicated to a computing device, for instance computing device **100** of FIG. 1. The communication of the compound drive may occur through multiple methods. The compound drive may be communicated to the computing device through a USB drive, a diskette, a hard drive, a CD-ROM, DVD, computer tape, or other well known computer storage media. Additionally, the compound may be communicated to the computing device through various types of transmissions or broadcasts. This may include communication through a wired or wireless connection, an internet connection, an infrared connection, a Bluetooth connection, a satellite connection, a radio connection or other communication methods known in the art. Any and all such communication devices and methods, and any combination thereof, are contemplated to be within the scope of embodiments of the present invention.

The communication of the virtual hard drive, the boot manager enhancer, and/or the translator at block **320** may be a single communication or may be distributed over various communication methods and communication times. In one

exemplary embodiment, the communication occurs over a network connection that connects multiple computing devices. An example is a large corporation that maintains a network to connect the many computing devices associated with the organization. The virtual hard drive, boot manager enhancer, and the translator are compounded into a single file that is communicated over the company's network. The company then communicates the compounded file to one, some, or all computing devices associated with the network. Communication of the compounded file facilitates the deployment of an operating system in an efficient and reliable manner. This efficient deployment is accomplished through the use one or more of the virtual boot manager enhancer, the translator, and a SCSI miniport driver.

Turning now to FIG. 4, a flow diagram is illustrated that shows an additional embodiment of an efficient method **400** for the deployment of an operating system, in accordance with an embodiment of the present invention. Initially, at block **410**, the virtual hard drive file is received. The virtual hard drive file is compounded with one or more of a boot manager enhancer and/or a translator. An embodiment of block **410** includes receiving a virtual hard drive file that has been compounded with both the boot manager enhancer and the translator. The virtual hard drive file contains one or more operating system instructions and computer modules to allow the computing device that receives the virtual hard drive file to perform an initial boot sequence with the virtual hard drive file.

Next, as indicated at block **420**, a boot manager is enhanced. Enhancement of the boot manager is accomplished with a boot manager enhancer. The boot manager is enhanced by the boot manager enhancer through the inclusion of a boot entry to the boot manager. The boot entry is directed to the virtual hard drive file which consequently exposes the virtual hard drive file as a bootable option to the computing device. An embodiment of the invention provides that the boot manager is enhanced by the boot manager enhancer such that a boot entry that exposes the virtual hard drive file is included in the boot manager, as illustrated by block **430**.

Next, as indicated at block **440**, the position of the virtual hard drive is determined, that is, a position of the virtual hard drive file relative to a physical drive that the virtual hard drive is stored in association with. In an exemplary embodiment the position is provided as a sector and an offset of the physical disk. The position of the virtual hard drive is then stored by the computing device, as illustrated at block **450**. The position is stored for later use by the translator to determine the translation between a physical offset and a logical offset of a read/write request.

Next, as indicated at block **460** the virtual hard drive is mounted. As previously discussed, when a drive is mounted a computing device associated with the mounted drive is able to access the data contained within the drive. An embodiment of the invention includes the use of a SCSI miniport driver to facilitate the mounting of the virtual hard drive file as a SCSI drive. As a result of this embodiment the virtual hard drive file is accessible by a computing device as a drive for reading and writing data.

Subsequently, as indicated at block **470** a translator is implemented to read/write requests. As previously discussed, a translator translates between physical offsets and logical offsets in read/write requests. In one exemplary embodiment the translation is based on the virtual hard drive file's position that was determined at block **440** and stored at block **450**. Position information facilitates the translation between a physical offset and a logical offset.

As indicated at block **480**, the initial boot sequence is then commenced. An initial boot sequence from the virtual hard drive file requires that the virtual hard drive was exposed as a bootable option, the virtual hard drive file's position was determined, the virtual hard drive file was mounted as a drive, a translator provided a translation between a physical offset and a logical offset, and the virtual hard drive file contained operating system instruction or other program modules.

With reference to FIG. **5**, a block diagram is illustrated that shows an exemplary computing system architecture **500** configured for use in implementing embodiments of the present invention. It will be understood and appreciated by those of skilled in the art that the computing system architecture **500** shown in FIG. **5** is merely an example of one suitable computing system and is not intended to suggest any limitation as to the scope of use or functionality of the present invention. Neither should the computing system architecture **500** be interpreted as having any dependency or requirement related to any single module/component or combination of modules/components illustrated therein.

Computing system architecture **500** includes a server **502** and a computing device **504** in communication with one another via a network **506**. The network **506** may include, without limitation, one or more local area networks (LANs) and/or wide area networks (WANs). Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet. Accordingly, the network **506** is not further described herein.

Each of the server **502** and the computing device **504** shown in FIG. **2** may be any type of computing device, such as, for example, computing device **100** described above with reference to FIG. **1**. By way of example only and not limitation, each of the server **502** and the computing device **504** may be a personal computer, desktop computer, laptop computer, handheld device, mobile handset, consumer electronic device, and the like. Additionally, the computing device **504** may further include a keyboard, keypad, stylus, joystick, and any other input-initiating component that allows a user to provide wired or wireless data to the network **506**. It should be noted, however, that the present invention is not limited to implementation on such computing devices, but may be implemented on any of a variety of different types of computing devices within the scope of embodiments hereof.

The server **502** may include any type of application server, database server, or file server configurable to perform the methods described herein. In addition, the server **502** may be a dedicated or shared server. Components of server **502** (not shown for clarity) may include, without limitation, a processing unit, internal system memory, and a suitable system bus for coupling various system components, including one or more databases for storing information (e.g., files and metadata associated therewith). Each server typically includes, or has access to, a variety of computer-readable media.

The server **502** includes a virtual hard drive **508**, a boot manager enhancer **510** and a translator **512**. In some embodiments, one or more of the illustrated components **508**, **510** and **512** may be implemented as stand-alone applications. In other embodiments, one or more of the illustrated components **508**, **510** and **512** may be integrated directly into the operating system of the server **502** and/or the computing device **504**. It will be understood by those of ordinary skill in the art that the components **508**, **510** and **512** illustrated in FIG. **5** are exemplary in nature and in number and should not be construed as limiting. Any number of components may be employed to achieve the desired functionality within the scope of embodiments of the present invention.

The virtual hard drive **508** may include operating system instruction and other computer modules that facilitate the deploying and booting of an operating system. Additionally, the virtual hard drive **508** may include drivers or other interfaces that may be required to expose and mount the virtual hard drive **508** as a drive in a computing device, such as computing device **504**.

The boot manager enhancer **510** provides information, data, or instructions that allows a boot manager to be enhanced such that a virtual hard drive **508** may be recognized as a bootable option to the computing device **504**. The boot manager enhancer **510**, in one exemplary embodiment, alters a boot manager of a computing system that is associated with the virtual hard drive file to include a boot entry. The addition of the boot entry in the boot manager allows the virtual hard drive file to be exposed and mounted as a drive to the computing device.

The translator **512** includes information, data, or instruction to translate read/write requests. The translation done by translator **512** is between a physical offset and a logical offset to allow the virtual hard drive **508** to be accessed as a drive by the computing device **504**. In an alternative embodiment, the translation of translator **512** translates between a position of the physical drive that stores the virtual hard drive file and a block position of the virtual hard drive file. The translator **512** allows the read/write requests generated by a computing device to be translated to requests that can access and manipulate data of the virtual hard drive **508**.

It will be understood by those of ordinary skill in the art that computing system architecture **500** is merely exemplary. While the server **502** and computing device **506** are illustrated as a single units, one skilled in the art will appreciate that the server **502** and computing device **504** are scalable. For example, the server **502** may in actuality include a plurality of servers in communication with one another and computing device **504** may include a plurality of computing devices in communication with one another and server **502**. The single unit depictions are meant for clarity, not to limit the scope of embodiments in any form.

As can be understood, embodiments of the present invention relate to methods and computer storage media for efficiently deploying an operating system. A compounded virtual hard drive file, that contains operating system instructions, is distributed to a computing device. Upon receiving the virtual hard drive file, the computing device is enhanced to allow the virtual hard drive file to be a boot option and a mountable drive. The compounded virtual hard drive file may contain additional data and information that will allow the virtual hard drive file to be exposed as a boot option and to be mounted as a drive in the computing device. The computing device may then utilize the virtual hard drive file as a virtual drive beginning with the initial boot sequence.

The present invention has been described in relation to particular embodiments, which are intended in all respects to be illustrative rather than restrictive. Alternative embodiments will become apparent to those of ordinary skill in the art to which the present invention pertains without departing from its scope.

From the foregoing, it will be seen that this invention is one well adapted to attain all the ends and objects set forth above, together with other advantages which are obvious and inherent to the system and method. It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the claims.

11

What is claimed is:

1. A method for deploying an operating system to a computing device, the method comprising:

communicating, from a server to the computing device, a virtual hard drive (VHD) file having one or more operating system instructions;

communicating a boot manager enhancer able to enhance a boot manager of the computing device;

communicating a translator able to apply a VHD file position at the computing device to read/write requests; and

the VHD file and at least one of the boot manager enhancer or the translator are compounded as a compounded drive prior to communicating from the server to the computing device, wherein the compounded drive is useable by the computing device for commencing an initial boot sequence.

2. The method of claim 1, wherein the VHD file, the boot manager enhancer, and the translator are communicated as a single file.

3. The method of claim 1, wherein the VHD file, the boot manager enhancer, and the translator are communicated as two or more files.

4. The method of claim 1, wherein the boot manager enhancer is able to enhance the boot manager with a boot entry that exposes the VHD file on the computing device.

5. The method of claim 1, wherein the translator is able to apply the VHD file position to read/write requests by translating requests between a logical offset and a physical offset.

6. The method of claim 1, wherein the VHD file is associated with an operating system loader and a kernel of the computing device, such that the translator is functional to apply to one or more of the boot manager, the operating system loader, or the kernel.

7. The method of claim 1, wherein the VHD file is able to be mounted within the computing device to create a mounted VHD file.

8. The method of claim 1, wherein the method further comprises loading a SCSI driver to facilitate communication between the VHD file and the computing device.

9. The method of claim 8, wherein the mounted VHD file is represented as a SCSI disk to the computing device.

10. One or more non-transitory computer storage media having computer-executable instructions embodied thereon that, when executed, perform a method for deploying a computing device operating system, the method comprising:

at a server, compounding a virtual hard drive (VHD) file and at least a boot manager enhancer or a translator as a compounded drive; and

12

communicating the compounded drive to the computing device, wherein the compounded drive is capable, at least in part, of performing an initial boot sequence on the computing device.

11. The media of claim 10, wherein the compounded drive is comprised of the VHD file, the boot manager enhancer, and the translator.

12. The media of claim 10, wherein the VHD file, the boot manager enhancer, and the translator are compounded so at least one of the VHD file, the boot manager enhancer, or the translator remain as an independent file.

13. The media of claim 10, wherein the method further comprises, the boot manager enhancer being associated with a VHD file boot entry that allows the VHD file to be exposed as a boot option to the computing device.

14. The media of claim 10, wherein the method further comprises translating between a logical offset and a physical offset utilizing the translator.

15. The media of claim 10, wherein the VHD file contains one or more operating system instructions.

16. The media of claim 10, wherein one or more of the VHD file, the boot manager enhancer, or the translator contain a SCSI driver.

17. The media of claim 10, wherein either the VHD file or the translator contain a SCSI driver to facilitate communication between the VHD file and the computing device.

18. The media of claim 10, further comprising mounting the compounded disk to create a mounted VHD file, wherein the mounted VHD file is exposed as a logical disk to the computing device.

19. The media of claim 18, wherein the mounted VHD file is recognized as a SCSI disk by the computing device.

20. One or more non-transitory computer storage media having computer-executable instructions embodied thereon that, when executed by a processor, perform a method for deploying an operating system to a computing device, the method comprising:

compounding a virtual hard drive (VHD) that can be exposed and mounted as a SCSI disk at the computing device and at least one of:

(1) a boot manager enhancer able to provide a boot entry that exposes the VHD as a boot option to the computing device, or

(2) a translator able to translate read/write requests between a logical offset and a physical offset based on a VHD file position at the computing device;

communicating from a server to the computing device the compounded VHD, wherein the compounded VHD is able to be utilized in an initial boot sequence of the computing device.

* * * * *